

We Claim:

1. A method of creating a tree-like data structure for use in carrying out range specified rule evaluations, the data structure having a rule specified rule set where each rule in the rule set has an equal number of fields and each field specifies a range having an upper and lower bound, there being the same number of layers in the structure as there are fields in each rule set, the method comprising:

creating a first layer of the structure made up of a set of non-overlapping ranges; and

creating one or more additional layers each made up of sets of non-overlapping ranges and sets of overlapping ranges;

wherein range specified rule evaluations are carried out by one pass through the data structure.

2. The method as defined in claim 1 wherein the data structure is a disjoint graph with the non-overlapping ranges representing elementary intervals and the overlapping ranges are disjoint intervals.

3. The method as defined in claim 2 wherein the range specified rule evaluations relate to packet classification in communications systems.

4. A system for creating a tree-like data structure for use in carrying out range specified rule evaluations, the data structure having a rule specified rule set where each rule in the rule set has an equal number of fields and each field specifies a range having an upper and lower bound, there being the same number of layers in the structure as there are fields in each rule set, the system comprising:

means for creating a first layer of the structure made up of a set of non-overlapping ranges; and

means for creating one or more additional layers each made up of sets of non-overlapping ranges and sets of overlapping ranges;

wherein range specified rule evaluations are carried out by one pass through the data structure.

5. The system as defined in claim 4 wherein the data structure is a disjoint graph with the non-overlapping ranges representing elementary intervals and the overlapping ranges are disjoint intervals.

6. A tree-like data structure stored on a computer readable medium for use in carrying out range specified rule evaluations, the data structure having a rule specified rule set where each rule in the rule set has an equal number of fields and each field specifies a range having an upper and lower bound, there being the same number of layers in the structure as there are fields in each rule set, the tree-like data structure having a first layer made up of a set of non-overlapping ranges; and one or more additional layers each made up of sets of non-overlapping ranges and sets of overlapping ranges; wherein range specified rule evaluations are carried out by one pass through the data structure.

7. The tree-like data structure as defined in claim 6 wherein the data structure is a disjoint graph with the non-overlapping ranges representing elementary intervals and the overlapping ranges are disjoint intervals for performing evaluations relating to packet classification in communications systems

8. A method of creating an augmented binary tree structure from a range specified rule set, each rule in the rule set having an equal number of fields and each field specifying a range having an upper and lower bound forming a set of intervals, the method comprising:

projecting end points of each interval of the set of intervals onto a line, the end points dividing the line into non-overlapping elementary intervals; and

forming the tree structure such that each node of the tree contains a single elementary interval, an indication of original intervals associated with the elementary interval, and pointers to any adjacent nodes in the tree.

9. The method as defined in claim 8 wherein the augmented binary tree structure is used for stabbing queries.

10. The method as defined in claim 8 wherein the augmented binary tree structure is an elementary interval tree for use in packet classification of computer-based communications systems.

11. A system for creating an augmented binary tree structure from a range specified rule set, each rule in the rule set having an equal number of fields and each field specifying a range having an upper and lower bound forming a set of intervals, the method comprising:

means for projecting end points of each interval of the set of intervals onto a line, the end points dividing the line into non-overlapping elementary intervals; and

means for forming the tree structure such that each node of the tree contains a single elementary interval, an indication of original intervals associated with the elementary interval, and pointers to any adjacent nodes in the tree.

12. The system as defined in claim 11 wherein the augmented binary tree structure is used for stabbing queries

13. The system as defined in claim 11 wherein the augmented binary tree structure is an elementary interval tree for use in packet classification of computer-based communications systems.

14. A method of creating a disjoint interval tree from a range specified rule set each rule in the rule set having an equal number of fields and each field specifying a range having an upper and lower bound forming a set of intervals, the method comprising:

combining overlapping intervals of the set of intervals to form larger intervals that are disjoint to each other; and

evaluating the overlapping intervals to find the maximum disjoint intervals for the set of intervals.

15. The method as defined in claim 11 for use in packet classification in a computer based communications system.

16. A system for creating a disjoint interval tree from a range specified rule set each rule in the rule set having an equal number of fields and each field specifying a range having an upper and lower bound forming a set of intervals, the method comprising:

means for combining overlapping intervals of the set of intervals to form larger intervals that are disjoint to each other; and

means for evaluating the overlapping intervals to find the maximum disjoint intervals for the set of intervals.

17. The system as defined in claim 16 for use in packet classification in a computer based communications system.

18. An augmented binary tree structure created in accordance with the method of claim 8 stored on a computer readable medium for classifying packets.
19. A disjoint interval tree created in accordance with the method of claim 14 stored on a computer readable medium for classifying packets.